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Patrol Vehicles: A Comparison between Sport Utility and Sedans

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By: Keith Traylor
Lake Jackson
Police Department
Lake Jackson Texas
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Abstract

For most Police agencies the purchase of patrol vehicles is a major part of the agencies annual budget. Therefore police administrators have to look at all applicable patrol vehicles to make the right decision based on the budget and the use of the vehicles. The sedan is the vehicle of choice but with new technology developing for patrol use the sport utility vehicle should be considered as a replacement.

Data was collected from many different tests on the performance and handling of sedans and four door sport utility vehicles. Results were compared in an attempt to determine the best vehicle for patrol use. Data was examined / compared within each category (Sedan to Sedan; SUV to SUV) and between the two (Sedan to SUV).

Based on the data collected and the findings of this research, police administrators will be able to make a better decision when purchasing a patrol vehicle. Depending on the use of the vehicle and the budgetary restraints a more practical vehicle can be purchased.

Table of Contents

Introduction

Review of Literature----- 1

Methodology----- 6

Findings -----7

Conclusion-----13

References -----15

Introduction

Over the years police vehicles have undergone many changes. These changes were due to government restrictions and the need for better and improved patrol vehicles. Many departments are in need of patrol vehicles that meet specific operational requirements. This research project will compare patrol vehicles past, present and future. It is intended that as a result of this research, departments will be able to choose a patrol vehicle that meets the needs of their department.

Patrol vehicles in law enforcement need to be able to withstand the punishment of every day patrol duties. Patrol vehicles are often times operated twenty-four hours a day seven days a week. This puts a tremendous amount of miles on a patrol vehicle during its lifetime. Studies have shown that mileage plays a big part in the efficiency of a patrol car (Yates, 1992). Torn Yates (1992) contends that departments will spend more on restoring a patrol vehicle than purchasing a new one. Yates also indicated that departments that restore vehicles would miss out on new developing technology that is being installed in the newer patrol vehicles.

This project is a comprehensive study that compares patrol vehicles of the past to the modern day patrol vehicle and looks at what the future holds for patrol vehicles. With the equipment that is needed for modern day law enforcement, patrol vehicles need to have ample room but still meet the rigid standards that have been imposed by the federal government. Which auto makes a better patrol vehicle, the sedan or sport utility vehicle? By using this research, departments will have a tool that will assist in providing the right patrol vehicle that meets the budgetary requirements and will provide maximum efficiency for each department.

Research information has been obtained from several sources. Numerous journals have been studied as well as studies from a number of organizations. In these studies the Michigan State Police and the Los Angeles County Sheriff's Department tested modern day patrol vehicles including the sport utility vehicle.

It is hypothesized that the sport utility vehicle could possibly be the patrol vehicle of the future. The sport utility vehicle will possibly be an efficient vehicle that will meet budgetary requirements.

This research project could affect many departments and will show the need to adopt a more versatile vehicle. Many smaller departments are concerned about public perception of the sport utility vehicle as a patrol vehicle. These departments will find that if the public is told about the change in proper ways, the idea of this change will be accepted. It is believed that eventually all departments will have to entertain the idea of the sport utility vehicle replacing the sedan.

Review of Literature

Looking back over thirty years there have been drastic changes in the patrol vehicle. In 1956 Dodge introduced its first police package vehicle and in 1957 Plymouth did the same. By the 1970s, eighty percent of the patrol vehicles were Dodge or Plymouth. In 1989 Dodge and Plymouth left the police vehicle market when they dropped the Diplomat and Grand Fury. In an attempt to re-enter the police vehicle market Dodge entered the Durango into the Michigan State Police tests in 1998. In 2001 Dodge entered three vehicles, the Intrepid, the Durango two-wheel drive and the Durango four wheel drive version. These vehicles ran a close comparison with Ford and Chevrolet in the roominess of the interior and the handling and acceleration portions of the test (Law Enforcement Technology, 2000).

In the early seventies patrol vehicles were large four door sedans. They were built using heavy duty materials that enabled the patrol vehicle to with stand the tortures of patrol duties. These vehicles had large engines that enabled the cars to run at high speeds. These engines were not fuel efficient and did not meet the stringent guidelines for pollution control as the engines of today.

In 1972 Jeep introduced the first sport utility vehicle into the police vehicle line. Though there were many sport utility vehicles on the market, the Jeep Cherokee 2-wheel drive was the first sport utility vehicle to be used as a patrol vehicle. The Jeep Cherokee has been in the police vehicle lineup longer than any other vehicle manufacturers (Sanow, 1999). Since the Jeep was introduced many other vehicle manufacturers have been introducing the sport utility vehicle into the police vehicle market. Ford, Chevrolet and Dodge all have sport utilities that are used in patrol and special operations.

Through the seventies the California Highway Patrol conducted experiments and performance tests with mid-size vehicles and compact vehicles with large powerful engines. These smaller vehicles were tested in the overall performance, operating characteristics and their ability to meet traffic law enforcement requirements. As times were changing law enforcement officers were going to be forced to adapt to smaller vehicles due to the 1985 Federal Corporate Average Fuel Economy Regulations and probable major model changes by vehicle manufacturers (Sellers, 1979).

In 1976 the Technological Innovation Center and the Denver Urban Observatory prepared a report describing the ideal police car. The report was intended to assist departments in choosing the right type of vehicle meeting all the needs required for patrol purposes. The vehicle would be designed with the characteristics of a sedan for roominess and weight, a sports car for the suspension, power and maneuverability of commercial vehicle for durability and maintenance.

The components of this vehicle would include an engine that could withstand constant driving at 30 miles per hour and then short or long sprints to emergency calls. A comparison should be made with the weight to power ratio. A 350 horsepower engine is considerably more effective in a three thousand pound car than a five thousand pound car. The engine should be suited to the vehicle for better acceleration in emergency situations. The engine in a patrol vehicle has to withstand the

daily routine of patrol. Most of the time a patrol car is traveling at low speeds, which is harder on the engine than high speed (Technological Innovation Center and Denver Urban Observatory, 1976).

One component that was looked at was the braking system. Disc brakes compared to drum brakes can make a big difference in the way a vehicle can handle. Most police vehicles are equipped with front disc brakes and rear drums. Studies have shown that during heavy and continuous braking the brakes tend to fail. The brakes could fail due to the rear drums heating up. The brake fluid can heat up, causing it to vaporize, allowing the fluid to bleed by the master cylinder causing brake failure. When the rear brakes start to fail there is a greater chance of the vehicle spinning out of control. The ideal solution to this problem would be to install disc brakes on all four wheels (Technological Innovation Center and Denver Urban Observatory, 1976).

Another component that was looked at was the frame. How strong should the frame be? Vehicle frames have gone through several changes over the years. The frame design is what gives a vehicle its strength. Frames are designed to collapse in certain locations in case of crashes to prevent passenger compartment damage. Vehicle frames lose their strength when welds break due to excessive use. As vehicle design improves, so does the frame (Technological Innovation Center and Denver Urban Observatory, 1976).

The vehicle suspension is another important vehicle component. The vehicle suspension should give occupants a soft and smooth ride while having the maneuverability of a sports car under high speed situations. Due to the suspension having to be harder to withstand high speed driving the comfort of a smooth ride is lost. More departments are requiring a more stable vehicle with leaf springs in the back and coil springs in the front, heavy duty stabilizer bars in the front and the rear

with heavy duty shocks front and back (Technological Innovation Center and Denver Urban Observatory, 1976).

The interior of a police vehicle is the policeman's home and office. The interior needs special attention because of the continuous use it is put through. A police officer may be in the vehicle for eight hours or more a day. This creates a serious problem with the upholstery and the carpets. Sagging upholstery will lend less support causing the officer to tire more easily. The discomfort could create back problems. The interior should be designed to give the officer enough room to be comfortable. The officer should have sufficient headroom so that entry and exiting the vehicle can be made quickly and safely (Technological Innovation Center and Denver Urban Observatory, 1976).

Perhaps the most important piece of equipment needed on a police vehicle is the warning system. The siren should be designed to emit sufficient decibels to warn motorists of approaching emergency vehicles. It has been recommended that the siren be placed above the vehicle facing forward. The lighting system should be placed on the roof. A minimum of two lights should be illuminated for optimum visibility (Technological Innovation Center and Denver Urban Observatory, 1976). In the mid-seventies studies were conducted to come up with a more improved police car. In these studies, engineers developed what they believed to be the police car of the future. Researchers looked at the different aspects and components that would make up a more economical and safer police car and the most effective approach to minimize the weight. Researchers developed ways to make a more productive police car by increasing the information the officer receives, improving communication, and designing a new body configuration especially for police use. The body configuration was comparable to that of the station wagon (Aerospace Cooperation, 1976).

One of the approaches that the researchers took was to reduce vehicle weight. This would increase fuel economy and reduce pollution. Vehicle diagnostics were being tested that would improve maintenance on the vehicles. Safety features included anti-lock brakes, carbon monoxide detectors, hand free communications, improved rearward visibility and improved seats and body restraints. To assist the officer in doing a more productive job a computer controlled digital communication system and data system was proposed (Aerospace Cooperation, 1976). The future of police vehicles holds many changes. Bellah's article suggested that the police vehicles of the future are going to be equipped with a 42- volt electrical system that would replace the 12- volt system that currently comes standard with police package vehicles. The alternators, being water cooled, will deliver 200 amps and 125 amps at idle. This will be able to handle all the electrical equipment that is being installed in the patrol vehicles. Some auto manufactures are looking at adding wiring harnesses for electrical equipment as a standard package. The frame and suspension will under go changes for better handling. Manufacturers will go back to the rear wheel drive vehicle. This is a more cost efficient vehicle when it comes to repairs and downtime. The engines will have increased horsepower and torque with better fuel economy and fewer emissions (Bellah, 2001a).

When police administrators look at procuring patrol vehicles different needs are looked at. Administrators look at what is best for the department. In 1989 the Ford LTD and the Chevrolet Caprice were the two standard Police package vehicles. Larger departments added after market emergency equipment. During this time there were conflicts between durability and performance. The Ford Mustang was used in 28 states for high-speed situations while the Ford Taurus was shown as a vehicle with excellent maneuverability, fuel economy, comfort and convenience. The process begins with department specifications that are submitted to the dealers for bids. Prices are

considered along with the performance, ergonomics and communications. Some agencies use sophisticated testing to compare vehicles such as the Michigan State Police Tests and the Los Angeles County Sheriffs Department vehicle tests (Levine; Martin 1989).

Methodology

What vehicle will make a more efficient patrol vehicle the sport utility or the sedan? Using all the research that has been compiled throughout the years, it is hypothesized that this research will show that the sport utility vehicle will become an efficient vehicle for all aspects of patrol duties. This research will also assist administrators when it comes to the procurement of patrol vehicles when comparing the sport utility to the sedan. Is the sport utility an acceptable replacement for sedans or will the sedan always be the accepted patrol vehicle?

For more than twenty years the Michigan State Police and the Los Angeles County Sheriffs Department have conducted yearly tests on vehicles that have been proposed for police vehicles by car manufacturers. The tests were conducted under a variety of driving conditions and using four drivers who are instructors in police driving. For the purpose of this research the test results from the Michigan State Police Tests 2000, 2001 and 2002 will be compared with the results of the Los Angeles County Sheriffs Department test in 2001.

Findings

Can the sport utility vehicle compare to the sedan to be a better patrol vehicle. In the beginning of this research it was hypothesized that the sport utility vehicle could possibly be the patrol vehicle of the future. Data was collected from the 2000-2001 Michigan State Police Tests (NLECTC, 1999) and the 2001 Los Angeles County Sheriffs Department vehicle test results (Bellah, 2001c). The Michigan State Police and the Los Angeles County Sheriffs Department conduct annual tests of police package vehicles submitted by automobile manufacturers. These tests are conducted to

evaluate and document the results to determine the best vehicle for the needs of police agencies. For the purposes of this research the data collected was analyzed and compressed to fit this research project.

Eight police package vehicles and two sport utility/specialty vehicles were entered into the test between in 2000 and 2002. The vehicles that were tested are:

- Chevrolet Camaro (manual six speed and automatic)
- Chevrolet Impala
- DiamlerChrysler Jeep Cherokee (two-wheel drive and four-wheel drive)
- Ford Police Interceptor
- Ford Expedition (four-wheel drive)
- Ford Explorer (two-wheel drive)
- V 01vos-70 T5 Sedan
- Volvo v-70 T5 wagon
- Hummer

Dynamic testing is to determine high-speed pursuit handling characteristics. Four drivers drive the vehicles on a two-mile road-racing course. Each vehicle is driven over the course for sixteen timed laps. The final score for each vehicle will be the average of twelve of the fastest laps.

Equipping the vehicles with DLS Smart Sensor-optical non-contact speed and distance sensor with lap top computers on board tested acceleration and top speed of the vehicles. The vehicles were driven through four acceleration sequences, two north bound and two south bound, allowing for wind direction. The four resulting times are averaged and the average times were used to derive the scores for acceleration.

Each vehicle was tested for deceleration rates and braking distances. The vehicles were tested in two deceleration runs from 90 mph to 0 mph at 22ft/s. each vehicle was equipped with a declinometer to maintain the deceleration rate. Each vehicle made two stops to heat up the brakes. After the heat up stops, the vehicles made six measured stops from 60 mph to 0 mph impending skid and with ABS on if equipped. Following a four- minute heat soak, the sequence is repeated. The initial velocity and distance to stop is recorded by means of a non-contact optical sensor with electronic speed and distance meters. The slowest deceleration rate was removed from each phase of the tests. The average deceleration rates were calculated from the remaining five stops in each phase. The vehicles score is based on the best ten stops.

The ergonomics of each vehicle was tested to see if each vehicle provided a suitable working environment for the patrol officer. Each vehicle was also tested to see it could accommodate the required communications and emergency warning equipment and assess the relative difficulty of such installations. Four officers compared and scored the vehicles on various comfort, instrumentation and visibility items. The Michigan State Police communications division scored and evaluated the vehicles in communications and installation. Fuel economy testing was scored based on the estimates for city and fuel economy to the nearest 1/10th mile per gallon. This data was developed from data supplied by the vehicle manufacturer. The data was certified by the Environmental Protection Agency. When a cost analysis was conducted, data showed that the sedan was more cost efficient than the sport utility vehicle. Due to the fact that the purchase of patrol vehicles takes up most of the department's annual budget administrators have to choose the most efficient vehicle. Data collected was from personnel communications with sales managers from Leo Martin Chevrolet Lake Jackson Texas, Bobby Ford - Ford, Mercury, Lincoln dealerships as well as HGAC (Houston Galveston area Council). HGAC prices patrol vehicles for law enforcement

agencies from dealerships around the state. The actual cost of each vehicle depends on the accessories that are built with each vehicle. The data collected is the base price of each vehicle and varies from dealership.

➤ Ford Police Interceptor	\$18,000.00
➤ Ford Expedition 4wd and 2wd	\$22,000.00 - \$24,000.00
➤ Ford Excursion 4wd and 2wd	\$30,000.00 - \$33,000.00
➤ Chevrolet Impala	\$18,000.00
➤ Chevrolet Camaro	\$20,000.00
➤ Chevrolet Tahoe 4wd and 2wd	\$22,000.00
➤ Dodge Intrepid	\$24,000.00
➤ Dodge Durango	\$20,000.00

These vehicles were tested for vehicle dynamics, acceleration and top speed, braking, fuel economy, ergonomics and communications. In vehicle dynamics the data collected, excluding the sport utility vehicle, showed the Chevrolet Camaro posted the fastest elapsed times on the road course. The 2002 and the 2003 Ford Police Interceptor had the second fastest times. The Dodge Intrepid had the third fastest time with the Chevrolet Impala coming in fourth. Although the Camaro had the fastest time in acceleration and had the best top speed of all vehicles tested, the Chevrolet Camaro line of vehicles have been discontinued by the manufacturer. This will leave the Ford 2002 and 2003 at the top of the sedan in speed comparisons. The Dodge Intrepid and Chevrolet Impala both are good candidates in the speed comparison. The Hummer was also tested but due to an Electronic Speed Restrictor the Hummers top speed is 90 mph. The Hummer should have been tested in the same category as the sport utilities.

In the acceleration, top speed and brake tests the same vehicles are tested for the acceleration rate from a standing stop, braking distance from a predetermined point and the top speed of each vehicle. In the acceleration rate the Chevrolet Camaro again came out on top with a top speed of 159 mph with the Dodge Intrepid second and the Ford 2002 and 2003 Police interceptor third. The Chevrolet Camaro accelerated faster and had a greater top speed but again this vehicle is not a particle patrol vehicle and the line has been discontinued. Comparing the data between the Chevrolet Impala and the Ford Police Interceptor the data shows that the acceleration rates are basically the same but the Dodge Intrepid has a greater top end speed of 135 mph to 129 mph on the 2002 Ford Police Interceptor and 127 mph on the 2003 Ford Police Interceptor.

Looking at the sport utility class in the same tests data reflects that the Dodge Durango (2WD) had the quickest time of 114 mph with the Dodge Durango (4WD) second at 112 mph. The rest of this class barely broke 100 mph. All the sport utility vehicles that were tested are equipped with electronic speed limiters. Comparing the data from the sedan tests, to the sport utility tests, it clearly shows that the sport utility is not quick enough or fast enough for most patrol uses in high speed driving.

In the braking portion of the tests, after all the tests were completed and results calculated the Ford 2002 Police interceptor had the best projected stopping distance of 139.9 feet from 60 mph. The Chevrolet Camaro was second with a projected distance of 140.8 feet from 60 mph. The Dodge Intrepid and Chevrolet Impala and the 2003 Ford Police Interceptor did not come close to the top two. Looking at the sport utility class for braking the Ford explorer (4WD) was the best at 140.9 feet from 60 mph. This distance is comparable with the sedan tests. The rest of the sport utility vehicles tested had stopping distances of 155 feet and greater from 60 mph. Because of the size and weight of these vehicles it takes longer to come to a stop than the sedan.

When comparing the ergonomics of all vehicles in the sedan and sport utility vehicle class the vehicles were scored and rated by looking at the different areas of the vehicles. The vehicles were scored on comfort of the front and rear seats, the instrumentation packages, vehicle controls, visibility and communications. Out of the sedan class the 2003 Ford Police interceptor scored the highest with the Chevrolet second. The 2002 Ford Police Interceptor was third with the Dodge Intrepid and Chevrolet Camaro scoring the least points.

Comparing the sport utility class data shows that the Ford Excursion (4wd) scored highest points with the Chevrolet Tahoe (2wd) second. The Chevrolet Tahoe (4wd) was third and the Ford Expedition (4wd) fourth. The Ford Explorer, Dodge Durango (2wd and 4wd) versions scored the least. The sport utilities were scored the same as the sedans.

When comparing the sedan and sport utility vehicles in the ergonomics category the data shows that the sport utility is the favorite. Due to the size of these vehicles there is more room in the interior that will allow for the use of all modern patrol vehicle equipment. Because of the large interior modern equipment can be installed leaving enough area for comfort of the driver as well as the passenger. The only problem facing the sport utility is that the vehicle is not designed for high speed or pursuit driving.

Looking at the data collected for fuel efficiency of the sedans, it was shown that based on the data supplied from the manufacturer the Chevrolet Impala had greater mile per gallon (MPG) rating than the rest. The Chevrolet Impala had a combined rating of 23 MPG. The Dodge Intrepid was second with 21 MPG and the Chevrolet Camaro was third with 20 MPG. The Ford 2002 Police Interceptor was last with 18 MPG and the 2003 Ford Police Interceptor has yet to be determined. There was no data collected in the tests that showed fuel economy comparisons in the sport utility vehicle class.

Conclusion

It was hypothesized in the beginning of this research that the sport utility vehicle would soon be the patrol vehicle of the future. Can the sport utility vehicle compare to the four- door sedan? As the data collected for this research shows, the sport utility vehicle or the specialty vehicle does compare in some ways to the sedan. But the practical patrol vehicle has to be able to conform to most all aspects of patrol duties. Where the sedan is better in handling, acceleration and braking, the specialty vehicle has better ergonomics. When looking at the future of the patrol vehicle, ergonomics will play a big role in the selection of vehicles. With available new technology, and technology that has yet to be developed, the interior of the patrol vehicle will have to be made to accommodate this technology without interfering with comfort. For a patrol officer to be efficient he or she must be comfortable being in the vehicle for extended hours.

Looking at the other aspects of patrol vehicle use, handling and acceleration also play a big role in patrol duties. The sedan is the best choice in handling and acceleration. Officers are many times required to accelerate rapidly and maintain high speeds in pursuit situations. Vehicles that do not handle efficiently at high speeds are a risk to the officer and other drivers or persons around a high speed situation. The specialty vehicle does not have the capability to handle properly in high-speed maneuvers. Braking plays a big role in patrol vehicles. The sedan stops quicker than the specialty vehicle. This makes high speed driving safer within crowded roadways.

Based on the data collected the findings the research do not support the hypothesis of this research. The sport utility or the specialty vehicle will not replace the sedan as the patrol vehicle of the future. The sedan is more practical for all patrol duties. Though the sedan is more practical the specialty vehicle will play a big role in larger agencies. The specialty vehicle can be used in many different aspects of patrol work. Many agencies are using the specialty vehicle for supervisor's

vehicles allowing for the necessary equipment to be carried and available when needed. Agencies are also using the specialty vehicle for crime scene units as well as tactical units. The specialty vehicle is also used as canine units. Although the specialty vehicle will not make a practical patrol unit and the data did not support the hypotheses of this research it can be easily shown that the sport utility vehicle can and will play a major role in Police Patrol duties.

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